

Space Shuttle Mission Chronology

1998

1). STS-89

2). STS-90

3). STS-91

4). STS-95

5). STS-88

(In chronological order)

STS-89 (8th Shuttle-Mir docking)

Endeavour

Pad A

- 89th Shuttle mission
- 12th flight OV-105
- 8th Shuttle-Mir docking
- 7th U.S. crew member on Mir
- 42nd KSC landing

Crew:

- Terrence W. Wilcutt, Commander (3rd Shuttle flight)
- Joe Frank Edwards Jr., Pilot (1st)
- Michael P. Anderson, Mission Specialist (1st)
- Bonnie J. Dunbar, Mission Specialist (5th)
- James F. Reilly II, Mission Specialist (1st)
- Salizhan Shakirovich Sharipov, Mission Specialist (Russian Space Agency)
(1st spaceflight)

Embarking to Mir -- Mir 24/25 crew member:

- Andrew S. W. Thomas, Mission Specialist and Cosmonaut Researcher
(2nd Shuttle, 1st Mir)

Returning from Mir -- Mir 24 crew member:

- David A. Wolf, Mission Specialist and Cosmonaut Researcher (3rd Shuttle, 1st Mir)

Orbiter Preps:

- OPF 1 -- March 28, 1997
- VAB -- April 8, 1997 (temporary storage)
- OPF 3 -- April 21, 1997
- VAB -- May 23, 1997 (temporary storage)
- OPF 1 -- June 4, 1997 (begin preflight processing)
- VAB -- Dec. 12, 1997
- Pad -- Dec. 19, 1997

Launch:

January 22, 1998, 9:48:15 p.m. EST Endeavour returned to space after completing its first Orbiter Maintenance Down Period, becoming first orbiter other than Atlantis to dock with Mir. On May 22, 1997, mission managers announced Endeavour would fly STS-89 instead of Discovery. Launch originally targeted for Jan. 15, 1998, changed first to no earlier than Jan. 20 and then Jan. 22, per request from the Russian space program to allow completion of activities on Mir. First launch overseen by one of two new rotational launch directors, Dave King, following retirement of veteran Launch Director Jim Harrington.

Landing:

January 31, 1998, 5:35:09 p.m. EST, Runway 15, Kennedy Space Center, Fla.
Rollout distance: 9,790 feet (2,984 meters). Rollout time: One minute, 10 seconds. Mission

duration: eight days, 19 hours, 46 minutes, 54 seconds. Landed on orbit 139. Logged 3.6 million statute miles. Landed on first opportunity at KSC, marking 13th consecutive landing in Florida and 20th in the last 21 missions.

Mission Highlights:

Docking of Endeavour to Mir occurred at 3:14 p.m. EST, Jan. 24, at an altitude of 214 nautical miles. Hatches opened at 5:25 p.m. EST the same day. Transfer of Andy Thomas to Mir and return of David Wolf to the U.S. orbiter occurred at 6:35 p.m. EST, Jan. 25. Initially, Thomas thought his Sokol pressure suit did not fit, and the crew exchange was allowed to proceed only after Wolf's suit was adjusted to fit Thomas. Once on Mir, Thomas was able to make adequate adjustments to his own suit (which would be worn should the crew need to return to Earth in the Soyuz capsule) and this remained on Mir with him. Wolf spent a total of 119 days aboard Mir, and after landing his total on-orbit time was 128 days.

Hatches between the two spacecraft closed at 5:34 p.m. EST, Jan. 28, and two spacecraft undocked at 11:57 a.m. EST, Jan. 29. More than 8,000 pounds (3,629 kilograms) of scientific equipment, logistical hardware and water were taken from Endeavour to Mir.

On Jan. 31, a new crew docked with Mir to begin a three-week handover. Thomas and his Mir 24 crewmates, Commander Anatoly Solvyev and Flight Engineer Pavel Vinogradov, greeted Mir 25 Commander Talgat Musabayev, Flight Engineer Nikolai Budarin and French researcher Leopold Eyharts following a soft docking on Jan. 31, just hours before the STS-89 crew touched down in Florida. Eyharts was to return to Earth Feb. 19 with the two Mir 24 cosmonauts, leaving Thomas, Musabayev and Budarin on Mir. Thomas, the last U.S. astronaut assigned to complete a lengthy stay on Mir, will return to Earth after a four-month stay as Phase I activities draw to a close.

STS-90 (Neurolab)

Columbia

Pad B

- 90th Shuttle mission
- 25th flight of OV-102
- 43rd KSC landing
- Final Spacelab module mission
- First KSC astronaut

Crew:

- Richard A. Searfoss, Commander (3rd Shuttle flight)
- Scott D. Altman, Pilot (1st)
- Richard M. Linnehan, Payload Commander and Mission Specialist (2nd)
- Dafydd "Dave" Rhys Williams, Mission Specialist (1st), (Canadian Space Agency)
- Kathryn P. "Kay" Hire, Mission Specialist (1st)
- Jay C. Buckey, Payload Specialist (1st)
- James A. "Jim" Pawelczyk, Payload Specialist (1st)

Orbiter Preps:

- OPF – Dec. 5, 1997
- VAB – March 16, 1998

Pad – March 23, 1998

Launch:

April 17, 1998, 2:19:00 p.m. EDT Launch postponed on April 16 for 24 hours due to difficulty with one of Columbia's two network signal processors, which format data and voice communications between the ground and the Space Shuttle. Network signal processor 2 was replaced, and liftoff on April 17 occurred on-time.

Landing:

May 3, 1998, 12:08:59 p.m. EDT Runway 33, Kennedy Space Center, Fla. Rollout distance: 9,998 feet (3,047 meters). Rollout time: 58 seconds. Mission duration: 15 days, 21 hours, 49 minutes, 59 seconds. Landed orbit 256, on first KSC opportunity for day. Logged 6.375 million statute miles. Marked 14th consecutive Shuttle landing at KSC and 21st in the last 22 missions.

Mission Highlights:

Neurolab's 26 experiments targeted one of the most complex and least understood parts of the human body – the nervous system. Primary goals were to conduct basic research in neurosciences and expand understanding of how the nervous system develops and functions in space. Test subjects were crew members and rats, mice, crickets, snails and two kinds of fish. Cooperative effort of NASA, several domestic partners and the space agencies of Canada (CSA), France (CNES) and Germany (DARA), as well as the European Space Agency (ESA) and the National Space Development Agency of Japan (NASDA). Most experiments conducted in pressurized Spacelab long module located in Columbia's payload bay. This was 16th and last scheduled flight of the ESA-developed Spacelab module, although Spacelab pallets will continue to be used on the International Space Station.

Research conducted as planned, with the exception of the Mammalian Development Team, which had to reprioritize science activities because of the unexpected high mortality rate of neonatal rats on board.

Other payloads included the Shuttle Vibration Forces experiment, the Bioreactor Demonstration System-04, and three Get-Away Special (GAS) canister investigations.

Working with engineers on the ground a week into the flight, the on-orbit crew used aluminum tape to bypass a suspect valve in the Regenerative Carbon Dioxide Removal System that had threatened to cut short the mission.

Mission Management Team considered, but decided against, extending the mission one day because the science community indicated an extended flight was not necessary and weather conditions were expected to deteriorate after planned landing on Sunday, May 3.

STS-90 Mission Specialist Kay Hire was Kennedy Space Center's first employee to be chosen as an astronaut candidate.

STS-91 (9th and final Shuttle-Mir docking)

Discovery

Pad A

- 91st Shuttle mission
- 24th flight OV-103
- 9th Shuttle-Mir docking
- Return of 7th and last U.S. astronaut to live and work aboard Mir
- First flight of Super Lightweight External Tank
- First docking mission for Discovery
- 44th KSC landing

Crew :

- Charles J. Precourt, Commander (4th Shuttle flight)
- Dominic L. Pudwill Gorie, Pilot (1st Shuttle flight)
- Wendy B. Lawrence, Mission Specialist (3rd Shuttle flight)
- Franklin R. Chang-Diaz, Mission Specialist (6th Shuttle flight)
- Janet Lynn Kavandi, Mission Specialist (1st Shuttle flight)
- Valery Victorovitch Ryumin, Mission Specialist (1st Shuttle flight, 1st Mir, 4th spaceflight)

Returning from Mir - Mir 25 crew member:

Andrew S. W. Thomas, Mission Specialist and Cosmonaut Researcher (2nd Shuttle, 1st Mir)

Orbiter Preps (move to):

- OPF 3 - Aug. 19, 1997 (temporary storage)
- OPF 2 - Oct. 1, 1997 (temporary storage)
- OPF 2 - Oct 30, 1997 (begin preflight processing)
- VAB - April 12, 1998
- Pad - May 2, 1998

Launch:

June 2, 1998, 6:06:24 p.m. EDT.The countdown proceeded smoothly except for a slight delay in operations to load the external tank with cryogenic propellant to evaluate a few technical issues. As planned, launch managers determined the exact orbital location of the Mir space station during the countdown's T-9-minute built-in hold. The decision was then made to launch Discovery at 6:06 p.m. EDT to achieve optimum Shuttle system performance and to accommodate Shuttle-Mir rendezvous activities.

Landing:

June 12, 1998, 2:00:18 p.m. EDT,Runway 15, Kennedy Space Center, Fla. Rollout distance 11,730 feet (3,576 meters). Rollout time: one minute, four seconds. Mission duration: 9 days, 19 hours, 54 minutes, 2 seconds. Landed on orbit 155. Logged 3.8 million statute miles. Landed on first opportunity at KSC, marking the 15th consecutive landing in Florida and 22nd in the last 23 missions.

Mission Highlights:

Docking of Discovery to Mir , the first for that orbiter, occurred at 12:58 p.m. EDT June 4 at an altitude of 208 miles. Hatches opened at 2:34 p.m. EDT the same day. At hatch opening, Andy Thomas officially became a member of Discovery's crew, completing 130 days of living and working on Mir. The transfer wrapped up a total of 907 days spent by a total of seven U.S. astronauts aboard the Russian space station as long-duration crew members. During the next four days, the Mir 25 and STS-91 crews transferred more than 1,100 pounds of water and almost 4,700 pounds of cargo experiments and supplies were exchanged between the two spacecraft. During this time, long-term U. S. experiments aboard the Mir were moved into Discovery's middeck locker area and the SPACEHAB single module in the orbiter's payload bay, including the Space Acceleration Measurement System (SAMS) and the tissue engineering co-culture (COCULT) investigations, as well as two crystal growth experiments. The crews also conducted Risk Mitigation Experiments (RMEs) and Human Life Sciences (HLS) investigations. When the hatches closed for undocking at 9:07 a.m. EDT June 8 and the spacecraft separated at 12:01 p.m. EDT that day, the final Shuttle-Mir docking mission was concluded and Phase 1 of the International Space Station (ISS) program came to an end.

The Alpha Magnetic Spectrometer (AMS) flew for the first time on this mission. The AMS, designed to look for dark and missing matter in the universe, was powered up on Flight Day 1. Data originally planned to be sent to ground stations through Discovery's KU-band communications system was recorded onboard because of a problem with the KU-band system that prevented it from sending high-rate communications, including television signals, to the ground. The system was able to receive uplink transmissions. On June 3 the crew was able to set up a bypass system that allowed AMS data to be downlinked via S-band/FM communications when the orbiter came within range of a ground station. Data that could not be recorded by ground stations was recorded onboard throughout the mission.

The KU-band system failure was determined to be located in a component that was not accessible to the crew. The failure prevented television transmission throughout the mission. Television broadcasts from Mir were prevented by a problem between a Russian ground station and the mission control center outside of Moscow, limiting communications to audio only on NASA television.

Other experiments conducted by the Shuttle crew during the mission included a checkout of the orbiter's robot arm to evaluate new electronics and software and the Orbiter Space Vision System for use during assembly missions for the ISS. Also onboard in the payload bay were eight Get Away-Special experiments, while combustion, crystal growth and radiation monitoring experiments were conducted in Discovery's middeck crew cabin area.

STS-95 (John Glenn's Flight)

Discovery

Pad B

92nd Shuttle mission

25th flight OV-103

45th KSC landing

1st U.S. President to attend a Shuttle launch

1st flight Space Shuttle Main Engine-Block II

Crew:

Curtis L. Brown, Commander (5th Shuttle flight)

Steven W. Lindsey, Pilot (2nd)
Scott E. Parazynski, Mission Specialist (3rd)
Stephen K. Robinson, Mission Specialist (2nd)
Pedro Duque, Mission Specialist (1st), European Space Agency
Chiaki Mukai, Payload Specialist (2nd), National Space and Development Agency
of Japan
John H. Glenn Jr., Payload Specialist (1st) (2nd spaceflight)

Orbiter Preps:

OPF — June 15, 1998
VAB — Sept. 14, 1998
Pad — Sept. 21, 1998

Launch:

October 29, 1998, 2:19:34 p.m. EST. At 12:30 p.m. EST, the hatch was closed with crew inside the Space Shuttle Discovery, just as President Bill Clinton's Air Force One plane touched down at the Cape Canaveral Air Station skid strip. The countdown proceeded to T-9 minutes, but was held an additional 8.5 minutes while the launch team discussed the status of a master alarm heard during cabin leak checks after hatch closure. Once the count picked up and the Orbiter Access Arm was retracted, the Range Safety Officer (SRO) requested a hold at T-5 minutes due to aircraft in the restricted air space around KSC. Once the aircraft cleared the area, the SRO gave the all clear signal and the countdown proceeded. Following main engine start, but prior to booster ignition, the drag chute compartment door fell off, but posed no problem for the mission. Managers decided not to deploy the chute upon landing.

Landing:

November 7, 1998, 12:04 p.m. EST, Runway 33, Kennedy Space Center, Fla. No drag chute deployed. Just after landing, Astronaut John Glenn said, "One G and I feel fine." Rollout distance: 9,508 feet. Rollout time: 59 seconds. Mission duration: 8 days, 21 hours, 44 minutes. Landed on orbit 135. Logged 3.6 million statute miles. Discovery landed on first opportunity at KSC, marking the 16th consecutive landing at KSC and 23rd in the last 24 Shuttle missions. This was Discovery's 13th landing at KSC and the 45th KSC landing in the history of the Shuttle program.

Mission Highlights:

The primary objectives of STS-95 included conducting a variety of science experiments in the pressurized SPACEHAB module, the deployment and retrieval of the Spartan free-flyer payload, and operations with the Hubble Space Telescope Orbiting Systems Test (HOST) and the International Extreme Ultraviolet Hitchhiker payloads being carried in the payload bay. The scientific research mission also returned space pioneer John Glenn to orbit — 36 years, eight months and nine days after he became the first American to orbit the Earth.

A slate of more than 80 experiments filled the nearly nine days in space. In addition to a variety of medical and material research, the crew released the Petite Amateur Naval Satellite, or PANSAT, to test innovative technologies to capture and transmit radio signals that normally would be lost because the original signals were too weak or contained too much interference. The crew also released the Spartan free-flying satellite to study the sun and the solar wind in a research effort to help scientists better understand a phenomenon that sometimes can cause widespread disruptions of communications and power supplies on Earth.

Medical research during the mission included a battery of tests on Payload Specialist Glenn and Mission Specialist Pedro Duque to further research how the absence of gravity affects

balance and perception, immune system response, bone and muscle density, metabolism and blood flow, and sleep.

The Hubble Space Telescope Orbital Systems Test provided an on-orbit test bed for hardware that will be used during the third Hubble servicing mission.

STS-88 (1st Space Station Flight)

Endeavour

Pad A

93rd Shuttle mission
13th flight OV-105
42nd KSC landing

Crew:

Robert D. Cabana, Commander (4th space flight)
Frederick W. "Rick" Sturckow, Pilot (1st)
Nancy J. Currie, Mission Specialist (3rd)
Jerry L. Ross, Mission Specialist (6th)
James H. Newman, Mission Specialist (3rd)
Sergei Konstantinovich Krikalev, Mission Specialist and cosmonaut, (4th space flight,
2nd on Shuttle, twice on Mir)

Orbiter Preps:

OPF – Feb. 1, 1998
VAB – Oct. 13, 1998
Pad – Oct. 21, 1998

Launch:

December 4, 1998, 3:35:34.075 a.m. EST. The originally scheduled launch of Endeavour on Dec. 3 was postponed for 24 hours when time ran out on the launch window. About T-4 minutes in the launch countdown, after orbiter hydraulic systems were powered on, a master alarm associated with hydraulic system number 1 in the crew cabin was noted. The countdown was held at T-31 seconds to further assess the situation. Shuttle system engineers attempted to quickly complete an assessment of the suspect hydraulic system and eventually gave an initial "go" to resume the countdown. With only seconds to respond, launch controllers were unable to resume the countdown in time to launch within the allotted remaining window. The launch was completed on time on Dec. 4.

Landing:

December 15, 1998, 10:53:29 p.m. EST, Runway 15, Kennedy Space Center, Fla. Rollout distance: 8,343 feet. Rollout time: 44 seconds. Mission duration: 11 days, 19 hours and 18 minutes. Landed on orbit 186, logging 4.6-million miles. It marked the 10th nighttime landing in the Shuttle program, the fifth at Kennedy Space Center, the 17th straight landing at Kennedy Space Center, the 24th in the last 25 Shuttle missions to land at the Florida spaceport, the 46th KSC landing in the history of the Shuttle program, and the ninth landing of Endeavour at KSC.

Mission Highlights:

During the 12-day mission to begin assembly of the International Space Station (ISS), all objectives were met. On Dec. 5, the 12.8-ton Unity connecting module was first connected to Endeavour's docking system; on Dec. 6, using the 50-foot-long robot arm, the Zarya control module was captured from orbit and mated to Unity; and astronauts Ross and Newman conducted three space walks to attach cables, connectors and hand rails. The two modules were powered up after the astronauts' entry.

Other EVA objectives were met as Ross and Newman tested a Simplified Aid for EVA Rescue (SAFER) unit, a self-rescue device should a space walker become separated from the spacecraft during an EVA; nudged two undeployed antennas on Zarya into position; removed launch restraint pins on Unity's four hatchways for mating future additions of station modules and truss structures, and installed a sunshade over Unity's two data relay boxes to protect them against harsh sunlight; stowed a tool bag on Unity and disconnected umbilicals used for the mating procedure with Zarya; installed a handrail on Zarya, and made a detailed photographic survey of the station.

Astronauts completed assembly of an early S-band communications system that allows flight controllers in Houston to send commands to Unity's systems and keep tabs on the health of the station, plus conducted a successful test of the videoconferencing capability of the early communications system which the first permanent crew will use. Krikalev and Currie also replaced a faulty unity in Zarya.

A new spacewalk record was established as Ross completed his seventh walk, totaling 44 hours, 9 minutes. Newman moved into third place with four walks totaling 28 hours, 27 minutes.

Significant dates and times of the mission included: Unity and Zarya were successfully engaged at 9:48 p.m. EST on Dec. 6; Unity came to life at 10:49 p.m. on Dec. 7; at 2:54 p.m., Dec. 10, Cabana and Russian cosmonaut Sergei Krikalev floated into the new station together, followed by the rest of the crew; at 4:12 p.m., Cabana and Krikalev opened the hatch to Zarya and entered; at 5:41 p.m., Dec. 11, Cabana and Krikalev closed the hatch to Zarya, and at 7:26 p.m., they closed the door to Unity. At 3:25 p.m. on Dec. 13, ISS flew free as Pilot Rick Sturckow separated Endeavour from the station.

Secondary objectives that were met were the successful deployment of the Shuttle's Ku-band antenna and the Hitchhiker payload, including the MightySat and SAC-A satellites.

Problem areas/unexpected events: When the Unity-Zarya fittings would not align properly, it was necessary for the robot arm to ungrapple Zarya. In addition, several construction items (slidewire carrier, worksite interface socket, retractable tether, trunnion pin cover) floated away from the orbiter; some floodlights failed during EVA; an incompatible connection was found between the activated carbon ion exchange and the hose assembly, but repaired; a camera on the Orbiter Space Vision System experienced binding during fast-rate operation, but could be used for slow-rate; and uncertainties surfaced about the unexpected depletion of the SAFER propellant, gaseous nitrogen.

